

Human Autonomy Teaming m:N Operations

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Human Autonomy Teaming Laboratory

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A few (not all) problems with many current automation implementations

- Brittle
 - Automation often operates well for a range of situations but requires human intervention to handle boundary conditions (Woods & Cook, 2006)
- Opaque
 - Automation interfaces often do not facilitate understanding or tracking of the system (Lyons, 2013)
- Miscalibrated Trust
 - Disuse and misuse of automation have led to real-world mishaps and tragedies (Lee & See, 2004; Lyons & Stokes, 2012)
- Out-of-the-Loop Loss of Situation Awareness
 - Trade-off: automation helps manual performance and workload but recovering from automation failure is often worse (Endsley, 2016; Onnasch, Wickens, Li, Manzey, 2014)

HAT Principles (Not Exhaustive) (Pros and Cons)

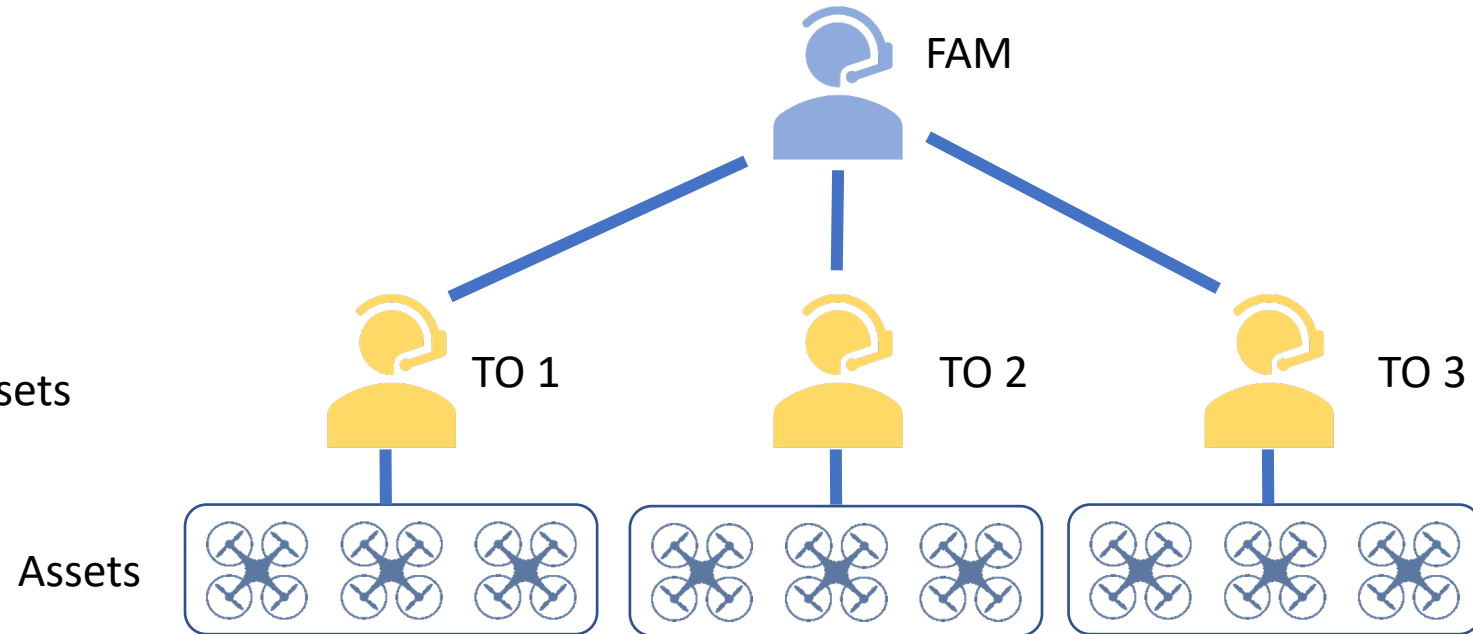
- Bi-directional Communication
- Transparency
- Shared situation awareness (mental model)
- Pilot directed interface
- Meaningful Human Control

M:N Aircraft Operations



M:N Configuration

- m:N Paradigm
 - Multiple operators to multiple vehicles, where:
 - m = # of operators
 - N = # of vehicles
- Roles in m:N operations:
 - Tactical Operator (TO)
 - Pilot-in-Command (PIC) of multiple assets
 - Monitors airspace and hazards
 - Attends to assets
 - Fleet Area Manager (FAM)
 - Responsible for overseeing a select number of TOs in a specific area
 - Monitors fleet health and system health
 - Evaluates TO performance and workload online



m:N Working Group (please join us)

- Initiated by Andy Thurling, NuAir and myself – JAN 2021
 - Quarterly meetings
 - 50 – 75 attendees; gov't, industry; research, operations
 - Sub-groups
 - Large auto-cargo, UAM, small UAS, HAPS, Swarms
- Working group
 - Identify Barriers and share solutions/lessons learned
 - Advocate for m:N operations
 - Standards Organizations
 - RTCA SC-228 DAA Use cases
 - Develop operational approval roadmap

M:N Activities (HAT Lab)

Human in the loop simulations

- Roles and responsibilities
- Hand-offs
- **Communication**
 - UAM (Wisk, Joby) (1:4, 2:20)
 - Small autonomous (Zipline) (1:15 – 20, 2:50)
 - DAA, contingency mgt – drivers
 - Fall 2022, Spring 2023
- Operational environment
- V & V



Summary

- Automation as a TEAMMATE
- Basic Principles
- Instantiate in m:N domain
- Working closely with industry partners to ensure operational significance and adoption